

CASE REPORT

An Uncommon Case of Dural Prostatic Adenocarcinoma Metastasis without Bone Involvement

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Abstract

Introduction: Prostate cancer is among the most commonly diagnosed cancers in men worldwide, with bone being its predominant metastatic site. Dural metastases, especially without vertebral involvement, are exceedingly rare and often underrecognized.

Case Presentation: We present the case of a 65-year-old male with Gleason score 4+3 (Grade Group 3) prostatic adenocarcinoma, who developed progressive lower limb weakness, urinary retention, and thoracic radicular pain. MRI of the spine revealed a posterior intradural extramedullary lesion at the D2 level with a Dural tail sign and right posterior intramedullary cord extension. Notably, no vertebral or systemic metastatic lesions were detected on full-body

imaging. CSF cytology confirmed malignant cells compatible with prostate origin.

Discussion: Dural spinal metastases from prostate cancer are uncommon, accounting for <0.04% of cases. They arise through hematogenous spread via Batson's plexus or leptomeningeal dissemination. This report highlights the radiologic characteristics, diagnostic approach, and management strategies of this rare entity, emphasizing its aggressive behavior and poor prognosis.

Conclusion: Despite advances in imaging and treatment, Dural spinal metastasis from prostate cancer remains a rare presentation with significant diagnostic and therapeutic challenges. Early identification via MRI and a multidisciplinary approach are vital for optimizing patient outcomes.

Key Words: Prostate cancer; Dural metastasis; Spinal MRI; Spinal metastases; Neuro-oncology; Batson's plexus; Dural tail sign

Introduction

Prostate cancer is the second most commonly diagnosed cancer in men, with over 1.4 million new cases annually, and remains a leading cause of cancer-related mortality worldwide [1]. Metastatic spread occurs in approximately 20%

of patients at diagnosis, predominantly to the axial skeleton (particularly the spine), lymph nodes, lungs, and liver [2].

Bone metastases occur in nearly 90% of patients with advanced prostate cancer, usually in the form of osteoblastic lesions [3]. However,

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Central Nervous System (CNS) involvement, including the brain and spinal cord, is rarely reported. Intradural spinal metastases, whether intramedullary or extramedullary, are exceedingly rare in prostate cancer, representing only 0.04% of cases in recent series [4].

Case Presentation

A 65-year-old man with histologically confirmed prostatic adenocarcinoma (Gleason score 4+3, PSA 28 ng/mL) presented with progressive paraparesis over three weeks, mid-thoracic pain, and urinary retention. Neurological examination revealed spastic paraparesis, hyperreflexia, bilateral Babinski signs, and a T4 sensory level. No cranial nerve or upper limb deficits were found.

MRI of the spine demonstrated a posterior intradural extramedullary lesion at the D2 vertebral level, showing intense enhancement and a Dural tail on T1-weighted post-contrast sequences. A focal posterior intramedullary extension into the spinal cord parenchyma was also noted. No vertebral or osseous abnormalities were present. (Figure 1). Brain MRI was unremarkable.

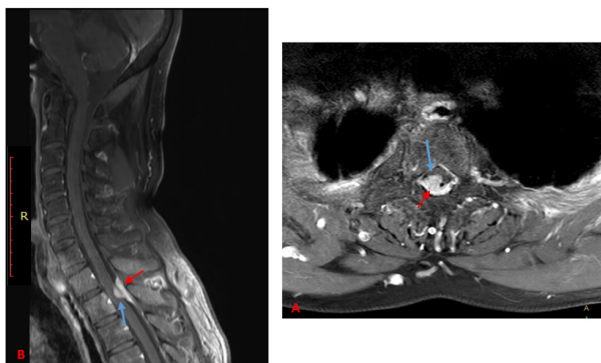


Figure 1) Magnetic resonance imaging of the cervico-dorsal spine. Axial (A) and sagittal (B) contrast-enhanced T1-weighted imaging of the spine MRI shows a focal dural mass at the level of D2 vertebrae (Red arrow) with intramedullary invasion (Blue arrow).

Systemic staging via CT chest/abdomen/pelvis and bone scintigraphy revealed no evidence of metastatic disease elsewhere. A lumbar puncture was performed, and CSF cytology

demonstrated malignant cells consistent with adenocarcinoma, supporting a diagnosis of metastatic prostate cancer.

Due to the location and intramedullary component, biopsy was not feasible. The patient received high-dose intravenous methylprednisolone (1g/day for 3 days, followed by tapering oral prednisone) and underwent palliative external beam radiotherapy to the thoracic spine (30 Gy in 10 fractions over 2 weeks). Neurosurgical decompression was considered but deferred due to the patient's functional decline and extent of spinal cord involvement. The patient experienced modest relief in radicular pain but persistent motor deficits.

Discussion

Prostatic adenocarcinoma is well recognized for its high metastatic potential, most frequently to the skeletal system, lymph nodes, and liver. Skeletal metastases specially those affecting the axial skeleton are the most commonly observed, reported in over 90% of men with metastatic prostate cancer [4].

The mechanisms of spread to the intradural space, particularly in the absence of vertebral involvement, remain a subject of ongoing investigation. Batson's seminal work described a valve less venous plexus that connects the pelvic venous system with the spinal venous circulation, facilitating retrograde, pressure-dependent tumor dissemination to the spine without first passing through the lungs [5]. This anatomical peculiarity may account for isolated spinal metastases without bony lesions. Additional routes include hematogenous dissemination through arterial microcirculation and leptomeningeal spread via cerebrospinal fluid, particularly when tumor cells breach the arachnoid barrier [3-6]. In our patient, the absence of vertebral signal changes on MRI

supports a non-contiguous mode of spread, favoring hematogenous or leptomeningeal involvement.

Clinically, the symptomatology of spinal intradural metastases varies depending on the lesion's anatomical location and the degree of spinal cord or nerve root involvement. Patients may present with localized or radicular pain, spastic paraparesis, ascending sensory deficits, and sphincter dysfunction, particularly urinary retention or incontinence [7]. Pain is often the initial symptom, followed by motor weakness and sensory loss as the lesion progresses. In the thoracic spine, cord compression may lead to a well-demarcated sensory level, often associated with hyperreflexia and Babinski signs, as was observed in our patient.

Spinal cord compression from metastatic disease is a neurologic emergency. Early recognition and imaging are critical to preserving function. Magnetic Resonance Imaging (MRI) remains the gold standard for detecting spinal metastatic involvement, with a reported sensitivity of 93–100% and specificity of 88–100% for identifying spinal epidural and intradural metastases, especially with contrast-enhanced T1-weighted sequences [8]. MRI can also delineate the extent of cord compression, intramedullary involvement, and soft tissue infiltration features critical for treatment planning. In our case, the progressive paraplegia, urinary retention, and thoracic sensory level were consistent with thoracic spinal cord compression, prompting urgent MRI evaluation. Given the rapid progression of symptoms, high suspicion is warranted in patients with a known primary malignancy, even in the absence of skeletal metastases.

Radiologic diagnosis of spinal intradural metastases is challenging. MRI remains the imaging modality of choice and is crucial in distinguishing intradural-extramedullary

from intramedullary and extradural lesions. Intradural metastases often appear as enhancing nodules within the thecal sac, occasionally with a “Dural tail sign”. [3]

Our patient's case is unique in demonstrating an isolated Dural metastasis without vertebral, cranial, or systemic involvement. MRI findings were characteristic, showing an intradural lesion with a Dural tail sign, raising initial differential considerations such as meningioma. However, the presence of intramedullary extension, known prostate cancer, and confirmatory CSF cytology strengthened the presumptive diagnosis of metastatic disease.

Radiologic differentiation between intradural extramedullary tumors (e.g., meningioma, schwannoma) and metastases can be challenging. A Dural tail sign is not pathognomonic and may occur in both neoplastic and inflammatory conditions [9]. In our case, the imaging pattern, combined with CSF findings and systemic evaluation, allowed for a diagnosis.

Management of intradural metastases is largely palliative and guided by the patient's overall clinical status. High-dose corticosteroids are often administered acutely to mitigate peritumoral edema. Radiotherapy, including conventional external beam radiation or Stereotactic Body Radiotherapy (SBRT), is widely used for local control. Surgery may be reserved for cases with accessible lesions, severe cord compression, or uncertain diagnosis, though outcomes are limited in cases with intramedullary extension or poor performance status. Androgen deprivation therapy remains the mainstay of systemic treatment for metastatic prostate cancer. However, its efficacy against CNS disease is limited, likely due to poor drug penetration across the blood-brain barrier [1,2].

The prognosis of patients with spinal intradural metastases remains poor. Survival following

diagnosis typically ranges from a few weeks to several months, with a median of 3–6 months in most series [4-6]. Functional outcomes are dependent on the severity of neurologic deficits at presentation and the rapidity of intervention. While durable neurologic recovery is rare, early diagnosis and a coordinated multidisciplinary approach can improve quality of life and delay further deterioration.

This case underscores the importance of maintaining a high index of suspicion for rare metastatic patterns in patients with prostate cancer, particularly those presenting with unexplained spinal symptoms. Radiological expertise and timely imaging are critical for diagnosis, while therapeutic decisions must be individualized based on neurological function, lesion resectability, and systemic disease burden.

Conclusion

Intradural spinal metastasis from prostatic adenocarcinoma is a rare and underrecognized manifestation, particularly in the absence of skeletal involvement. MRI remains the cornerstone for diagnosis, and early intervention is crucial for symptom control. Awareness of this atypical presentation is essential for timely diagnosis and multidisciplinary management, although the overall prognosis remains guarded.

This case highlights the need for thorough diagnostic evaluation, including CSF analysis, and underscores the importance of multidisciplinary collaboration in managing such complex presentations.

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